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United States Department of Agriculture

Forest Service

Northeastern Forest Experiment Station

Amherst, Mass.

(Established 1923)

ANNUAL INVESTIGATIVE PROGRAM

1930

1929-1930

January 29, 1930

NORTHEASTERN FOREST EXPERIMENT STATION
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STATION PERSONNEL

Permanent

J. S. Boyce (Resigned September 30, 1929)	Director
C. Edward Behre (Appointed November 30, 1929)	Director
M. Westveld	Silviculturist
Paul W. Stickel	Associate Silviculturist
Victor S. Jensen (Transferred to Station, March 9, 1929)	Assistant Silviculturist
H. J. MacAloney (Bureau of Entomology)	Assistant Entomologist
Perley Spaulding (Bureau of Plant Industry)	Senior Pathologist
J. R. Hansbrough (Bureau of Plant Industry) (Left Station, May 1, 1929)	Assistant Pathologist
P. R. Gast (In cooperation with Harvard Forest; resigned June 30, 1929)	Agent
Mary E. Turrell	Senior Clerk
W. B. Barrows	Computing Clerk
Kathryn E. O'Neil (Resigned September 30, 1929)	Assistant Clerk
Esther E. Scott (Appointed July 15, 1929)	Assistant Clerk

Temporary

J. W. Chalfant
R. B. Craig
D. W. Cumming
R. K. Daley
E. J. Eliason
Harold Eno
Gustav W. Genth
John E. Hetzel
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P. F. O'Sullivan
J. J. Truncer
J. S. Turrell
M. A. Westveld

Collaborators

M. F. Morgan, Connecticut Agricultural Experiment Station
H. B. Peirson, Maine Forest Service

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Northeastern Forest Experiment Station

Annual Investigative Program 1930

General:

The situation in regard to the broader phases of the work of the Northeastern Forest Experiment Station remains essentially the same as reported in last year's investigative program. Progress toward the ultimate goal of more adequately covering the field of forest research for the region has been somewhat hampered by another change of directorship. The new director, moreover, although acquainted with the region from previous experience, has hardly had time in his present capacity to become thoroly familiar with all phases of the station's program in relation to the needs of the region. It is to be expected, therefore, that the program for 1930 should adhere closely to work already under way and to policies set up and followed by the previous administration.

In surveying the work of the station, several things stand out clearly as basic to consideration of any plans for the future.

First: it seems important to concentrate every effort for the present on driving to speedy conclusion current phases of several of the important major projects, namely; the analysis of forest fire statistics (Pf, D-2), weather and fuel relationships (Pf, B-5), studies of stem form (ME-1), and analysis of data collected in 1924 on growth on cut-over lands in the spruce types (Mc-1). The station has been devoting a large share of its resources to these studies over a long period of years and it is highly desirable that the results be made available as quickly as possible and that the decks be cleared for prosecuting vigorously other phases of these studies or for undertaking new projects.

In the second place, it should be emphasized that unless resources of the station are increased it is almost essential to effective work to continue to concentrate activities on a few lines of investigation centered largely in only one of the important forest regions of the station's territory. In this connection, it is of interest to note that of all the eastern forest experiment stations established prior to 1927, the Northeastern is the only one which has not received substantially enlarged appropriations to enable it to deal more adequately with its problems.

Similarly, development of our branch stations on the White Mountain National Forest will have to proceed very slowly until more adequate appropriations for the work are available.

Finally, consideration of almost any important silvicultural problem emphasizes the need of cooperative study by specialists in various fields in order to arrive at a satisfactory or well rounded result. This has been especially noticeable in the case of the problems on the station program which have been attacked primarily from the entomological viewpoint.

After two seasons' study of the deterioration of birch in the northern hardwood types which seemed to be the result of an attack by the bronze birch borer fol-

lowing opening up of the stand by logging or thinning, the entomologists have shifted their attention to other factors which now appear to be of more importance than the borer. Strong indications of primary parasitic action of a widely distributed, usually saprophytic fungus have been revealed and the service of our pathologist will now be enlisted in the attacking of the problem. Further than this, preliminary work indicates that such radical changes in environmental factors following cutting exist that it is entirely possible that the deterioration may be primarily the result of the inability of the trees to adjust their life processes to the changed conditions. This may call for the services of a silviculturist or physiologist before the final solution is reached.

Again, all previous work on the white pine weevil points to silvicultural management as the only practical method of ultimate control and the suggestions of the entomologists in this respect, especially as regards reforestation of land not supporting any hardwood growth, will require much attention from the silviculturists before entirely satisfactory practices are evolved. But failure to develop satisfactory control of this insect in the field of entomology leads directly to the possibility of meeting the situation more satisfactorily with the assistance of specialists in other lines. The possibility of finding an attractant bait which would make possible the trapping of the weevils in large numbers has not yet been studied, and entering this field will doubtless call for the services of a chemist of highly specialized training. Up to the present no more than incidental attention has been given to study of the relation of other forms of life to weevil population. We know practically nothing of what happens to the weevil during the long period spent on the ground and investigation by a biologist might show that the weevil is an important source of food to mice, moles, birds, or other animals, the population of which could be artificially stimulated. It is extremely desirable at the present time to provide a biologist to attack this phase of the problem.

In our silvicultural studies we should not wait until the silviculturist on the job finds himself unable to proceed further before considering cooperative study by specialists in other lines. The ability of a pathologist, entomologist, or biologist to properly handle any given situation which may develop will depend largely on his familiarity with conditions previously in existence on the area under consideration, and for this reason all major silvicultural experiments should be closely followed from the start by men in these fields. No study of methods of cutting, for example, can be considered comprehensive unless the results of the cuttings have been studied from a pathological, entomological, and biological point of view as well as simply in their silvical relations.

Branch Stations, Experimental Forests and Research Reserves.

Nothing has been done during the past year toward selection of additional branch stations or experimental forests thruout the region. In the sprout hardwoods region, the Mount Toby Forest of the Massachusetts Agricultural College and the Harvard Forest continue to serve as centers of work until more extensive plans are laid for studies in this region.

During the past year a field party was engaged in preparing topographic and forest type maps of the experimental forests at Gale River and Bartlett, New Hamp-

shire. The Gale River area which comprised about 2,700 acres in the preliminary selection, has been reduced to 1,217 acres by eliminating most of the original tract lying east of the road running north from the Franconia Notch-Twin Mountain highway past the guard station to Bethlehem Junction. The area eliminated consists entirely of poplar-birch old burn type. A considerable block of this type is included in the area retained in the experimental forest.

About two-thirds of the Bartlett area was covered by the mapping last fall. Because of the uniformity of forest type over the area it has been definitely decided to reduce the size of the tract finally incorporated into the experimental forest. Decision on boundaries of area to be retained should be made this year. For this reason it will probably not be necessary to complete the mapping of the original area.

During the coming season it is planned to work out an intensive plan for the protection, improvement, and development of the Gale River area in cooperation with the White Mountain National Forest. This plan will provide for the location of roads, trails, buildings, and other logging improvements and will consider also possible subdivision of the tract for purposes of management. Plans for the most urgent silvicultural operations needed will also be made as it is hoped that experimental cuttings can be initiated by disposing of stumpage to local people.

Careful study of the Gale River area supports the preliminary opinion that this tract does not contain suitable stands of merchantable spruce and hardwoods in which to establish plots needed to supplement those already established at Cherry Mountain and Waterville in connection with our studies of methods of cutting and slash disposal. For this reason it is definitely planned to establish more plots at Cherry Mountain in cooperation with the White Mountain National Forest when the timber sale on the east side of the valley is inaugurated this year. Because of the situation with respect to available stands and cutting operations in the White Mountains region, Cherry Mountain and Waterville will continue to serve as centers of work for many years to come. Both these areas are readily accessible by automobile from the Gale River Experimental Forest.

No definite recommendations have yet been made on the establishment of "Research Reserves" in the Northeast. In cooperation with the White Mountain National Forest, agreement on a fine tract of accessible virgin timber in the Waterville valley was reached, but investigation during the past summer revealed the fact that the softwood timber had been removed from this tract in the period immediately preceding the transfer of title to the land to the United States. Mr. Westveld has since that time located a block of about fifty acres on the slopes of Mount Osceola about three and a half miles from Waterville Inn, which represents typical virgin conditions in the mixed spruce and hardwood type. Before final decision on this area is made, it is planned to make a reconnaissance of Cascade Brook, Snyder Brook, the Great Gulf, and other areas around Mount Washington definitely reserved from all cutting by the national forest administration.

Administrative Research:

Administrative research on the White Mountain National Forest is being carried out under five headings:

A series of four plots aggregating 5.3 acres, not including a check, were laid out on the Benton Fuelwood area in 1927 to study the effect of varying methods of cutting and of grazing in mixed hardwoods comprising chiefly birch, poplar, and maple.

On a large area near Bartlett from which merchantable mixed hardwood and softwood was removed in 1924-1925, studies are being made of the establishment, growth, and survival of white ash seedlings and sprouts. Two 6'x6' quadrats for intensive study were established in 1927, and on other areas white ash reproduction has been weeded and all but promising sprouts removed from old stumps. It is concluded that cultural operations for white ash should be limited to best ash sites.

Studies of the girdling of hardwood wolf trees were started in 1925 with the girdling of 70 trees to determine the effectiveness of the girdling by removal of bark and the effect on growth of reproduction. Thru the use of the silvicultural improvement fund extensive experimental girdling operations were started in the Waterville valley in 1929. This work included comparison of three methods of girdling, costs, effect of size of trees, thickness of bark, etc. Three 1-acre sample plots were laid out. The importance of trained, competent men was emphasized by this study because good judgment must be used to avoid loss of time in girdling trees not doing enough damage to warrant the work, and to accomplish the girdling in the most effective manner.

In the Waterville valley experimental work in brush disposal has also been undertaken.

As a part of a program covering the entire eastern district, the White Mountain National Forest is starting a survey of cut-over areas to study the effect of various methods of cutting and the development of reproduction. This survey will doubtless require all the time the administrative staff can devote to investigative work for the next year or so.

There are only two important timber sale areas on the White Mountain National Forest. These are at Cherry Mountain and at Waterville. In both of these areas the experiment station has undertaken intensive permanent sample plot studies. From the above discussion it will be seen that the administrative force has not been able to do a great deal in the establishment of permanent sample plots, but that some effort has been made to study results in varying types and that present plans call for a more adequate check on success of past operations in securing satisfactory reproduction.

Expansion Program:

It has been previously emphasized that with existing appropriations the Northeastern Forest Experiment Station can study adequately only a few of the important problems of the region, and for this reason it has confined its activities largely to the spruce region of northern New England and New York. Under the McSweeney-McNary Act of 1928 a comprehensive program of forest research for the nation was set up, contemplating rapid expansion of all the existing forest experiment stations over a ten year period. Up to the present the Northeastern station has not participated in the increased appropriations resulting from this act. During the past year, how-

ever, the Director of the station drew up a plan outlining three important projects which should be undertaken as soon as money became available. These three projects in the order in which they were recommended are:

(1) a comprehensive study of forest planting and plantations.
(2) growth and yield in many-aged stands of mixed spruce and hardwoods.
(3) silviculture of the spruce-hardwood types.

These recommendations were approved by the Northeastern Forest Research Council. The situation has not changed during the past year and appropriations under section 2 of the McSweeney-McNary Act sufficient to undertake the entire program outlined should be sought this year in order to meet the needs of the region and keep abreast of development at other stations.

Cooperation:

During 1929 the Northeastern Forest Research Council held only one meeting. This was in Springfield, Massachusetts on February 26. The council discussed current work of the station and a program for expansion.

Cooperation with the Massachusetts Agricultural College has continued on the same satisfactory basis as heretofore. However, the station was not called upon during the past year to offer the usual course in forest ecology, due to substitution of other work by the college and lack of time for the group of graduate students concerned to take both courses.

In the fire weather study continuation of observations at the four stations was made possible thru the cooperation and assistance of the Harvard Forest, Maine Forest Service, Finch, Pruyn and Company, New York Conservation Department, and the New York State College of Forestry.

Cooperation with the Bureau of Plant Industry has continued on the same basis as heretofore, Doctor Perley Spaulding with an assistant devoting full time to work in the Northeast.

Doctor H. J. MacAloney of the Bureau of Entomology continues his assignment to the Northeast but during the past year has maintained headquarters at the New York State College of Forestry in Syracuse, New York where he received his doctor's degree in June. Further cooperative work in forest entomology was rendered by R. S. Hall in continuing his studies of the bronze birch borer, financed jointly by the Bureau of Entomology, and the School of Forestry and Conservation, University of Michigan.

The experiment station has continued to furnish the Weather Bureau with daily reports from its stations at Elk Lake, New York, and Smyrna Mills, Maine, and the weather bureau has continued its fire weather forecast service from Albany, New York, Boston, Massachusetts, and New Haven, Connecticut.

Projects:

There are now 26 projects on the program, 11 major and 15 minor. On 4 major and 5 minor projects dealing with protection from fire, insects, and disease, all the work is being done by cooperating bureaus of the Department of Agriculture. One major project (ME-2) is now completed and two more (ME-1 and Pf,D-2) require only completion of the reports to close them out as at present constituted. A fourth major project (T-1) has been discontinued with reports on past work completed, but this will be renewed upon the return of Doctor Gast from Europe. Five of the minor projects are incidental in character. The projects are distributed as follows:

	Major	Minor
Botany	0	1
Forestation	0	1
Management	2	5
Mensuration	2	3
Protection	6	5
Types	1	0
	11	15

1930 Minor Project

BOTANY

Project

Phenological observations of trees and shrubs in the Northeast (B-Phenology).

Scope

To correlate phenological observations with certain natural phenomena considered as important operating factors in the studies being undertaken by the Station.

Status

Flowering, fruiting, and leafing habits of trees can be definitely tied in to silvicultural and protective measures. Fire weather conditions, emergence of insects, fruiting of fungi, etc., may be correlated with certain stages in phenological processes. This project was added in 1928 at the request of the Washington office. Its success will depend on the cooperation that can be obtained.

Progress for 1929

None.

Plans

It is planned to make a definite request for cooperation from various agencies during the current year.

Assignment

Staff, Northeastern Forest Experiment Station, in cooperation with interested agencies throughout the Northeast.

FORESTATION

Project

Source of seed - Scotch pine (Fs-d-1).

Scope

To determine the relative desirability of stock raised from Austrian and Baltic Scotch pine seed for planting in the Northeast; the relative development of Scotch pine, red pine, and white pine in the same site; and the feasibility of planting Norway spruce for Christmas tree stock in mixture with pine.

Status

A series of 4 plots on the Mount Toby State Demonstration Forest, Sunderland, Mass., each a half acre in size, located in an old pasture, were planted in the spring of 1924 as follows: Plot 1, 2-year-old Baltic Scotch pines; Plot 2, 2-year-old Austrian Scotch pine; Plot 3, 2-1 red pine; Plot 4, 2-1 white pine. Trees were planted 6.6' x 6.6'. The west half of each plot was interplanted with 3-year-old Norway spruce, one spruce being planted in the center of each 6.6' x 6.6' square. Counts are made annually.

Results

Austrian Scotch pine so far shows the best development, followed by red pine, white pine, and Baltic Scotch pine. The interplanting of Norway spruce is doing particularly well in the Baltic-Scotch pine section of the plantation.

Progress for 1929

The project has now settled down to a yearly inspection and count.

Publications and reports

Office memoranda showing results of annual examinations.

Plans

Annual examinations will be continued. No cultural work needed yet.

Assignment

M. Westveld, in cooperation with Massachusetts Agricultural College and Massachusetts Conservation Commission.

MANAGEMENT

Project

Practice of forestry by private owners (M-1, WO).

Scope

To secure information as to the extent to which forestry is being practiced by private owners, the general character of the work being done, and the results secured; and to encourage the practice of private forestry by personal contact, addresses, correspondence, general publicity, publications, and demonstrations.

Status

The situation is essentially the same as reported in detail last year.

Progress for 1929

No specific additions to previous information secured during 1929.

Publications and reports

None.

Plans

Data will be secured on new developments and assistance to private owners rendered as rapidly as work on other projects permits, and, as far as possible, in connection with them.

Assignment

Staff, Northeastern Forest Experiment Station.

1930 Minor Project

MANAGEMENT

Project

Management of sprout hardwood stands (M-2).

Scope

To determine the best methods for cutting, reproduction, and subsequent handling of sprout hardwood stands in southern New England.

Status

Five permanent sample plots each 1/10 acre in size were established in 1924 in sprout hardwood land in the Simsbury State Forest, Connecticut. Three of these are on land recently burned, and 2 on adjacent unburned land. One burned plot and 1 unburned plot were thinned at the time of establishment. Sprouts were counted on the thinned plots in 1925 and cut so as to leave 1 or 2 of the strongest in each clump. On the other burned plots the sprouts were counted but no thinning was done.

Results

It is evident from the examination of the plots that fire of the character which swept over the area in April, 1924 results in killing practically all of the trees in young oak stands. Developments so far indicate that scarlet oak sprouts come up prolifically and put on more rapid growth than white oak sprouts. It is also apparent that a new sprout stand coming in following a burn can be greatly aided in its development by weeding out the stems killed by the fire, since these, on falling over, bend and seriously cripple the new stand of sprouts.

Progress for 1929

In accordance with the project plan, Plot 26 of the series was reburned in March. The entire set of plots was completely remeasured in May.

Publication and Reports

Typewritten progress reports in files.

Plans

The plots will be visited during the spring of 1930 to determine whether any further cleaning is desirable on Plot 27. Steel wire nails which were used in tagging the trees in 1924 will be replaced with copper nails.

Assignment

M. Westveld, in cooperation with Connecticut State Forester.

1930 Minor Project.

MANAGEMENT

Project

Replacement of chestnut (M-3).

Scope

To determine the natural and artificial replacement of chestnut on blight-killed areas, and what species should be favored from the standpoint of silviculture.

Status

In June, 1924, 2 ¼-acre permanent sample plots were laid out on the Mount Toby Demonstration Forest, Sunderland, Mass. The plots were established on an area where blight-killed chestnut had been removed in 1919, and the area planted to 2-2 northern white pine. All trees and stumps were tagged. The height of all the pines was measured. For the chestnut, data were secured on the height and diameter of the stumps, average and maximum height of sprouts in each clump, and number of live and dead sprouts in each clump. In each plot a map was prepared showing the location of all tagged trees by numbers and species. In 1925, the plots were remeasured and permanent corner posts were put in. Beginning that year, the pines on one plot have been favored by cutting back all hardwood sprouts. The plots were remeasured and the hardwoods on one plot weeded in 1926. During the 1927 remeasurement, a third plot, 1/10 acre in size was established in an adjacent stand where the dead chestnut is still standing. The third plot will serve as a check plot for the natural replacement of blight-killed chestnut. All plots were re-examined in 1928, field data brought up-to-date, and new maps prepared for the pine plots.

Results

The replacement of the chestnut by the pines is entirely successful. Although the present basal area per acre does not differ much between the treated plots and the check, the growing stock of the pine plots is composed almost entirely of a valuable species (northern white pine), whereas on the check plot less than 50 per cent of the growing stock is composed of commercially important species.

The annual release cuttings on one of the pine plots are just beginning to show their effects. Prior to the time weeding was initiated (1924) the average heights of pines on the treated and untreated plots were 3.7 and 4.2 feet respectively. In 1928 the average heights were 10.0 and 9.9 feet respectively for the treated and untreated pine plots. The average diameter breast height in 1928 was the same for both plots, 1.5". On a crown class basis, the treated plot in 1928 had 70 per cent of its members in the dominant and co-dominant classes, while in the case of the untreated plot only 49 per cent of the pines were in the two highest crown classes.

Since the broadcast weeding in 1925 on the treated plot, subsequent release cuttings have been confined largely to individual trees. Very little of this cultural operation was necessary in 1927 and 1928. The average height of the pines on the treated plot in 1928 was almost equal to that of the chestnut sprouts. The average height of the pines was 10.0 feet and for the chestnut sprouts 10.1 feet. On the untreated plot the chestnut sprouts on an average overtopped the pines by nearly two feet; in 1928 the average heights of the pines and chestnut sprouts were 9.9 and 11.7 feet respectively.

Progress for 1929

All plots remeasured in the fall of 1929. Field data brought up to date and first progress report prepared.

Publications and Reports

Korstian, C. F. and Stickel, P. W. The natural replacement of blight-killed chestnut in the hardwood forests of the Northeast. Journal of Agricultural Research 34:7, 631-648, 9 figures, 3 tables. April, 1927.

_____ The natural replacement of blight-killed chestnut. U.S.D.A.Misc. Circular 100, 15 pages, 4 plates, 1 table. April, 1927.

Stickel, P. W. First progress report of the chestnut replacement plots, Mount Toby Demonstration Forest. Typewritten. 15 pages, 9 tables. January, 1930.

Plans

Plots to be remeasured in 1930 and at 5 year intervals thereafter. Since the replacement of the chestnut on the pine plots is complete, it is planned to convert them into a problem of the management of northern white pine plantation. One pine plot will be held as a check. On the plot where the hardwoods have been cut back, such cultural operations as weeding, thinning, and improvement cuttings will be carried on.

Assignment

P. W. Stickel, in cooperation with the Massachusetts Agricultural College.

1930 Minor Project

MANAGEMENT

Project

Management of eastern hemlock (M-4).

Scope

To determine the best methods for the cutting, reproduction, and subsequent handling of hemlock in both pure and mixed stands.

Status

Three 1/4-acre plots were established in 1924. Hardwood canopy cut clear, releasing hemlock understory; Hardwood brush removed from half of each plot, and left scattered on remainder; red and white pine planted on two of the plots at rate of about 1000 per acre. One plot left unplanted as check. Hardwood sprouts overtopping pine or hemlock were cut back, and a retally of planted stock was made in the spring of 1926. Cutting back of all hardwood sprouts and complete retally made in winter of 1929-1930. A cumulative herbarium, showing succession of vegetation, has been kept with collections made in 1924, 1925, 1926, and 1928.

Work to date has been confined to a study of the development of a stand of planted red and white pines in an understory of hemlock, which had been released by clear-cutting hardwoods for fuelwood. Attention has been given to the following points:

(a) Recovery and rate of growth of hemlock of different sizes and in different positions.

(b) Effect of hemlock upon survival and development of inter-planted red and white pines.

(c) Severity of competition of hardwood sprouts with hemlock and pine.

(d) Influence of scattered hardwood brush.

(e) Succession of vegetation after removal of hardwoods.

Results

Most of the deaths of planted pine have been due to shading by hardwood sprouts. But in some cases the increase in size of the hemlock crowns has had a suppressing effect on the pine. Some of the red pines, however, are surprisingly vigorous, although growing directly under hemlocks. Mortality of the planted stock was higher among the plants of low initial vigor than among the more vigorous individuals. Hemlock has grown vigorously since the establishment of the plot, and no ill effects from removal of hardwood canopy are discernible. Surface vegetation has come in very rapidly on all the plots. Several significant changes in its composition have been noted. The check plot has become an almost impenetrable thicket of hardwood sprouts, in which residual conifers of small size are making little growth.

Progress for 1929

Cutting back of all hardwood sprouts, and complete remeasurement of hemlock and pines accomplished at the close of the year.

Publications and reports

None.

Plans

Preparation of progress report summarizing results of recent remeasurements. Continue observations and periodic remeasurement. Herbarium collections for study of succession of vegetation will be continued biennially.

Assignment

C. Edward Behre, in cooperation with Massachusetts Agricultural College.

MANAGEMENT

Project

Permanent sample plots (M-5).

Scope

To maintain the permanent sample plots which are under the jurisdiction of the Northeastern Forest Experiment Station.

Status

A total of 174 permanent sample plots comprising approximately 77 acres are now handled by the station. The annual investigative program of 1929 contains a table showing for each set of plots the location, purpose of the experiment, timber type, acreage, year of establishment, and the time the plots are to be remeasured. Sixty three of these plots have been established by the station since its organization in 1923, and the remainder were previously established by the Forest Service. All the plots established by the station have been in connection with definite projects and some of the previously established plots are now proving valuable for current projects.

A complete card index of the plots by states, by projects, and by number has been prepared which greatly facilitates the handling of the records. The old records have been largely transferred to new standardized forms and all the information of individual plots brought together.

Results

A summary of the results obtained from the analysis of two sets of old plots, one a series of methods of cutting and the other a series of girdling plots, appears in the 1929 investigative program. A more detailed discussion of the girdling experiment and the conclusions reached appears in the May, 1929, number of the Canadian Woodlands Review.

Progress for 1929

Continued progress was made during the year in transcribing the field data from the old forms to the permanent office record forms. An examination was made during the year of the old Forest Service plots located near West Rochester, Vermont. These plots have a direct bearing on the "Methods of cutting and reproduction in spruce types" project Mc-1. Progress on some of the plots is reported under the projects which they serve, namely: M-3 and M-4. A new series of fire half-acre girdling plots were established at Waterville.

Publications and reports

Westveld, M. The establishment of permanent sample plots for study of methods of cutting. Mimeographed. 23 pp. 1926.

_____ Results of the hardwood girdling experiment at Corbin Park, New Hampshire. Typewritten, 8 pp. January, 1929.

_____ Maintaining pulpwood species on cutover lands. Canadian Woodlands Review 1(1):21-24. 5 figures. May, 1929.

A summary of permanent sample plots by all agencies in the region. Mimeographed. 40 pp. 1927.

Plans

Approximately 80 plots are due for the regular 5-year remeasurements during 1930. All of these plots belong to the old series established by the Forest Service some 25 years ago. As rapidly as possible the data will be analyzed and progress reports prepared.

Assignment

Victor S. Jensen.

1930 Major Project.

MANAGEMENT

Project

Slash disposal (Mb-1).

Scope

To determine (a) the relation of slash of various species to protection of forests from fire, disease, and insects; and (b) the desirability of various methods of slash disposal.

Status

In 1925 a study of the rate of disintegration of the slash of northern white pine (Pinus strobus) was started in cooperation with the Harvard Forest. This included a study of the influence of insects in promoting decay and a study of humidity and temperature in the upper and lower parts of piles of white pine slash. The former has been concluded and the latter discontinued because of lack of suitable instruments. Some results have been published but observations on progress of decay must be continued.

A study of the hardwood slash problem was also begun in 1925. Examination of

slash on various aged cuttings in mixed spruce and hardwoods have been supplemented by more intensive studies on several permanent sample plots which have been established in the White Mountains of New Hampshire. The first set of 2 plots, each 4.2 acres in size, located on a comparatively flat bench was established in 1925. On 1 plot both hardwood and softwood slash was lopped; on the second no slash disposal was practiced. In 1926, 3 more plots each 3.6 acres in area with an easterly exposure were established. The same types of slash disposal were practiced as in the first series, and in addition the method of burning softwood slash and leaving hardwood tops intact was practiced. Maps made of the plots show location of skid roads and trails, stumps, residual trees, and slash piles and also the character of slash with respect to height, density, and species of which composed. Tallies of reproduction on milacre transects were also made and observations on slash deterioration were made at intervals. In 1928 two sets of 3 plots each, representing different exposures were established on the White Mountain National Forest. The set on Johnson Brook has northeast and the Snow Brook set a westerly exposure. Each plot is 2 acres in size. On each set the treatment is similar to that followed on the 1926 plots. The Snow Brook plots were cut over in the winter of 1928-1929. The Johnson Brook set will be cut during the winter of 1929-1930.

In connection with the above studies of slash decay, about 3500 specimens of wood rotting fungi have been collected, identified, and filed with proper records, which will make them valuable in future problems connected with the decay of wood.

During 1928 two weeks were spent visiting the experimental cutting plots of the Anglo-Newfoundland Development Company on Harpoon Brook, Newfoundland, and in examining slash and collecting wood rotting fungi at Spruce Brook, Newfoundland. About 100 collections were made. General conditions at the places visited were much like the upper spruce slopes in the White Mountains. The fungi were the same and the rate of decay equally slow.

Results

Technical Bulletin 132, U.S.D.A., gives detailed results of study of decay of white pine slash. The entomological phases of the work have been concluded with the following results. Insects influence decay by loosening the bark, making it fall off earlier than it otherwise would, and thus delay rather than accelerate decay. In a few instances it appeared that rot entered some of the larger burrows of the wood borers and began to spread outward earlier than it otherwise would. This occurred but a few times and could hardly be considered an important factor in accelerating decay.

Results so far obtained in the study of hardwood slash decay appear in an article in the Journal of Forestry, March, 1929.

Two extreme conditions have been found to limit rate of decay of hardwoods; namely, quick and excessive seasoning and waterlogging. Factors influencing decay within these extremes are:

(1) Species of tree. In order of increasing durability the principal species are: aspen, poplar, paper birch, basswood, beech, maple, yellow birch, ash, oak, and chestnut.

(2) Rate of growth; thru effect on relative amount of sap and heartwood. Aspen, poplar, and basswood show practically no difference in decay of sap and heartwood; paper birch, beech, maple, and yellow birch show moderate differences; while ash, oak, and chestnut show very marked differences, with correspondingly durable heartwood.

(3) Direction of slope: Differences between south and north slopes are so pronounced that careful consideration of local conditions must govern slash disposal practice.

(4) Moisture of air and soil: Different species react characteristically to moisture. Some waterlog very easily; others scarcely do so under extreme conditions. Beginning with those waterlogging most readily, the species rank as follows:- yellow birch, beech, oak, basswood, aspen, maple, poplar, paper birch, chestnut, and ash. In general, a soil with moisture conditions suitable for growth of corn or potatoes is most favorable for rapid decay of slash in contact with it.

Lopping can hasten the rate of decay of the less durable woods very little, - so little that its cost is not justified. Such species are aspen, poplar, paper birch, and basswood. Lopping of maple and beech depends on local conditions, but usually yields too little result to justify expense. Yellow birch, because of its extreme readiness to waterlog, should rarely be lopped. Ash, chestnut, and oak in most situations will give maximum results from lopping.

Intensive mapping and study of one set of permanent plots, supplemented by observations on old cut-over areas, revealed the following facts: (1) Thirty-nine per cent of the area was covered with slash; (2) classifying slash on the basis of density, 18% of each area was covered with dense slash, 11% with medium, and 10% with light. (3) Dense softwood slash not only crushes and kills the advance reproduction beneath it, but effectually prevents the establishment of new reproduction on all areas occupied by it for a period of from 15 to 20 years. (4) Hardwood slash rarely hinders reproduction seriously for more than 5 or 6 years. (5) Unlopped hardwood tops, because of their open character, permit a certain number of seedlings to push their way thru without undue interference. Lopping hardwood tops increases the chances for smothering seedlings. Lopping softwood tops does not improve conditions for present or incoming seedlings.

In 1927 the Forest Service discontinued the requirement of lopping hardwood slash on the White Mountain National Forest. This has resulted in a saving of about $2000 a year.

Progress for 1929

Little has been done on extensive reconnaissance of decay of slash. Initial observations of decay on a set of three plots on the west side of Snow Mountain were made. The reproduction transects on these plots were retallied and the residual trees were tagged and measured. All other permanent plots were visited during the year and additional specimens of wood rotting fungi collected. It was found that the hardwood reproduction is so dense and grows so fast as to overshadow most of the slash in the second year. This tends to prevent drying out and favors waterlogging, to an unexpected degree, making studies of waterlogging necessary. All data on this are being collected and digested for further studies of this very important factor in slash decay.

The screened slash experiments were inspected in company with the entomologist. It was concluded that this type of experiment has given all the data likely to be secured in this way.

Publications and Reports

Spaulding, Perley. References to literature on slash disposal as they bear upon Northeastern conditions, with brief abstracts. Mimeographed, 16 pp. November, 1925.

_____ The role of fungi in the disposal of slash. Proceedings, Forest Protection Conference at Syracuse, New York. 11-13. November, 1926.

_____ The decay of slash of northern white pine in southern New England. U.S.D.A. Technical Bulletin No. 132, 20 pp. July, 1929.

_____ The decay of hardwood slash in northern New England. Journal of Forestry, 27(3):241-245. March, 1929.

_____ Report on the experimental cutting plots established on Harpoon Brook, Newfoundland by the Anglo-Newfoundland Development Company in 1921. Typewritten, 2 pp. December, 1928.

Westveld, M. Report on experimental areas of the Anglo-Newfoundland Development Company on Harpoon Brook, Newfoundland. Typewritten, 5 pp. December, 1928.

Plans

Reproduction transects on the Johnson Brook plots will be retallied and residual trees tagged and measured in 1930.

Decay is getting under way on the oldest plots and a steadily increasing amount of time will be given to study of the progress of decay. Opportunities for reconnaissance of slash in special situations or under special conditions will be utilized as much as possible.

As soon as suitable areas are to be cut, at least one additional set of plots will be established to complete the series of exposures represented.

Assignment

Perley Spaulding, M. Westveld, and H. J. MacAloney, in cooperation with the Harvard Forest.

MANAGEMENT

Project

Methods of cutting and reproduction in spruce types (Mc-1).

Scope

To determine (a) the best method of cutting to secure satisfactory natural reproduction in the shortest possible time, and (b) the rate of growth of seedlings and larger trees left after cutting.

Status

This study is being conducted thru the establishment of a large number of temporary sample plots, supplemented by permanent sample plots, on which various methods of cutting are being tried out. During 1924 and 1925, 420 temporary plots were established thruout the spruce region. Four ½-acre permanent plots were established in 1924 on Cherry Mountain in the White Mountain National Forest; two in 1927 on the Battell Forest in Vermont, and two in 1928 in the Waterville Valley, White Mountain National Forest. Eighteen permanent methods of cutting plots established by the Forest Service in New Hampshire and Vermont about 25 years ago help to form the basis of this study.

During 1927, 2 series of weeding plots in 4-year-old cuttings, one on the Battell Forest of Vermont, the other in the White Mountains, were established. Another series of three weeding plots was established in 9-year-old spruce cuttings in the Waterville Valley in 1928. These plots were subjected to weedings of varying degrees of intensity to determine their effectiveness in increasing the representation of spruce and fir in the next rotation.

To determine what type of seed bed is favorable to spruce and fir, 38 plots were laid out on the Cherry Mountain area in 1926; 48 in 1927; and 50 in 1928. These plots were sowed to spruce and fir seed. Tallies are made several times each season to record germination and survival.

Studies of soil types on the methods of cutting plots located at Cherry Mountain are being made in cooperation with M.F.Morgan of the Connecticut Agricultural Experiment Station.

In 1928 a study was made of 12 sample plots in Newfoundland in which various methods of cutting and slash disposal were tried out.

Results

Some of the more important facts brought out by the study are: (1) cut-over spruce lands are generally well stocked with spruce and fir reproduction; (2) nearly all this reproduction is advance growth which was present in the stand prior to cut-

ting; (3) regardless of the severity of the cutting, most areas show an abundance of reproduction; (4) quantity of reproduction varies with forest type, spruce-slope showing the largest number, spruce-flat next, and spruce-hardwood least; (5) in general, the largest number of spruce and fir seedlings were found on areas which had originally supported the largest volume of spruce and fir; (6) where beech and hard maple form an appreciable portion of the stand, any type of cutting, unless followed by special cultural treatment, results in the rapid encroachment of hardwoods on areas formerly occupied by spruce and fir; (7) in the undisturbed forest, spruce maintains its dominance over fir without much difficulty; clear cutting, with its resulting changes, transfers this supremacy to the fir; (8) competing hardwood growth is the most disturbing single factor operating to prevent the final establishment of spruce and fir; (9) clear-cutting of spruce and fir halts additional restocking of these species for many years following cutting. On the other hand prolific seeding of large residual hardwoods results in the establishment of much additional hardwood growth; (10) promiscuous cutting of young growth in some instances may be chiefly responsible for the conversion of former mixed spruce and hardwood stands into pure hardwoods.

Progress for 1929

The four ½-acre plots at Cherry Mountain which were established in 1924 were completely remeasured in 1929. The remeasurement work included the recharting of 32 intensive vegetation quadrats. Humus samples obtained at intervals during the remeasurement period from the permanent plots were sent to the Agronomy Department at the Massachusetts Agricultural College for analysis. Soil profiles from virgin spruce stands in Waterville were obtained and are being analyzed at the Connecticut Agricultural Experiment Station. 64 seed bed condition plots were sowed to spruce and fir seed this fall. Reproduction tallies on all seed bed condition plots were conducted during the season. A series of five ½-acre girdling plots were established in the Waterville Valley on which partial and complete girdling of hardwoods to release spruce was tried out. The weeding plots on Battell Forest were inspected in July and 1/3 of the check plot weeded to study the effect of midsummer weeding as against late summer weeding on the sprouting capacity of hardwoods.

Publications and Reports

Westveld, M. Logging damage to advance reproduction. Journal of Forestry, 24(5):579-582. 1 table. May, 1926.

_____ Observations on cut-over pulpwood lands in the Northeast. Journal of Forestry, 26(6):649-664. 2 tables. 2 figures. May, 1927.

_____ Suggestions for the management of spruce stands in the Northeast. Typewritten, 30 pp. December, 1928. (To be published as Department circular, Forest Service.)

_____ Reproduction on pulpwood lands in the Northeast. Typewritten, 85 pp., 24 figures, 27 tables, 17 plates. May, 1927. (To be published as a technical bulletin, Forest Service).

_____ Report on the experimental cutting plots established on

Harpoon Brook, Newfoundland by the Anglo-Newfoundland Development Company in 1921. Typewritten, 4 pp. November, 1928.

_____ Maintaining pulpwood species on cut-over lands. Canadian Woodlands Review. 1(1):21-24. 5 figures. May, 1929.

_____ How full stands of pulpwood may be grown. Canada Lumberman 49(20):44-46. 5 figures. October, 1929.

_____ Girdling hardwoods to release spruce and balsam fir. Technical Notes No. 1. May 8, 1929. 1 page.

_____ Pulpwood crops in the Northeast. U.S.D.A.Leaflet 8 pages. 1930.

Plans

Many of the old Forest Service plots established 25 years ago in the spruce region will be remeasured in 1930. An attempt will also be made to visit and remeasure some of the semi-permanent plots established during 1924 and 1925 for study of growth on cut-over land. Tallies of reproduction on seed bed condition plots will be continued and additional plots laid out. Continued cooperation with the Connecticut Agricultural Experiment Station in the study of soil types and their relation to reproduction condition is planned for the coming year. Additional methods of cutting plots will be established on the Cherry Mountain area if the proposed sale there is consummated.

Assignment

M. Westveld

1930 Major Project

MENSURATION

Project

Development of universal taper and volume tables (ME-1).

Scope

To determine the conformity of various species to a form equation which can be used for the construction of standard taper curves, and the application of such curves in mensuration work. Attention has been given to the following lines:

1. Conformity of various species to a form equation.
2. Study of fundamental principles of tree growth.
3. Improvement of technique for preparing volume tables by the form class taper curve method.
4. Study of factors affecting average form of stands of spruce and fir, and of methods of determining average form in the field.

5. Study of factors affecting butt swell and bark thickness of spruce and fir.

6. Study of comparative form of species in mixture.

7. Study of change in form of residual spruce and fir trees after logging.

Status

Results under objective 1 have been completed and published. Under objective 2, measurements were taken in 1927 and 1928 on six white pine trees in cooperation with the Harvard Forest. The march of diameter growth at breast height and at a point half way up the stem is recorded on these trees by means of a vernier and tape. The treatment of the individual trees is designed to show the effect of thinning and pruning upon changes of stem form. In addition, the study affords some basis for correlating growth at breast height and at a point half way up the stem with meteorological conditions, especially wind movement. During the 1928 season the tape measurements were supplemented by a continuous dendrograph record of growth at breast height on one of the trees. The dendrograph was furnished by the New York State College of Forestry at Syracuse, New York. The records for 1928 have not been analyzed as yet.

Under objective 3, several mathematical and graphical improvements in technique of preparing form class volume tables have been incorporated in the publication presenting results of objective 1. The attempt to eliminate the artificial effect of height upon form quotient by the use of a new form index had to be given up because no practical method of converting the new normal diameters to actual breast height diameters could be found.

A final report covering objectives 4, 5, and 6, is in preparation. The results are based on measurements of 2,189 trees representing a wide variety of types, mixtures, ages, sites, and densities. The analysis included calculation of a large number of multiple correlations on the more important of which corrections for curvature have been made.

Under objective 7 careful measurements were taken in 1924 on 41 red spruce and 40 balsam fir trees prior to logging on the Mc-1 permanent sample plots at Cherry Mountain, New Hampshire. These trees have been described and tagged and crown maps of the entire area before and after logging have been prepared, so that the change in form after logging could be followed by subsequent remeasurement at five-year intervals. Many of the trees measured have since been destroyed by windfall.

A memorandum reporting results of an attempt to study effect of a cutting 50 years before measurement is in the files.

Results

Results covering objectives 1 and 3 were published in the Journal of Agricultural Research in 1927. In this paper it was shown that a large number of commercial conifers conform satisfactorily to the stem curve equation advanced by the author, and that this equation lent itself to simple mathematical and graphical manipulations as the basis for volume tables which could be applied in a practical manner. A detailed analysis of the sources of error in applying volume tables was also included and certain advantages of the form class system pointed out.

Although results under objectives 4 and 5 were not as uniform or as satisfactory as might be desired, it appears that average form quotient may in general be estimated from diameter, height, and site index, or diameter, height, and crown per cent. For old growth red spruce it was found that form quotient 73 would apply quite generally independent of mixture, except where stands had been culled or broken, when form quotient 70 should be used.

Although butt swell is shown to be dependent upon the diameter of the tree to a certain extent, very little of the variability of butt swell could be associated with any of the measurable factors. Practically all the variability of bark thickness which can be accounted for is also associated with diameter.

Since little could be learned of factors influencing butt swell alone, attention has been devoted to developing an equation or chart for estimating the combined effect of butt swell and bark thickness on the breast height diameters, for use in applying form class volume tables in practice. For even-aged stands the total reduction of breast height diameter for butt swell and bark thickness may be most satisfactorily estimated from diameter and age, and on old growth stands, where age is meaningless, diameter alone will be used.

The data proved inadequate as a basis for detailed study of comparative form of species in mixture (objective 6). All that may be said is that in mixtures white spruce and balsam will usually average lower in form quotient than red spruce.

Progress in 1929

Some progress in preparation of a report was made in 1929 but Behre did not devote as much time to the work as was intended. Remeasurement of trees at Cherry Mountain was not accomplished, due to lack of personnel.

Publications and Reports

Behre, C. E. Preliminary notes on studies of tree form. Journal of Forestry 21(5):507-511. 1 table. May, 1923.

_____ Is taper based on form quotient independent of species and size? Journal of Forestry 22(3):282-290. 3 figures, 1 table. March, 1924.

_____ Computation of total cubic contents of trees. Journal of Forestry 22(6):62-63. October, 1924.

_____ Comparison of diameter tape and caliper measurements in second growth spruce. Journal of Forestry 24(2):178-182. 2 tables. February, 1926.

_____ Charts for application of percentile taper curves to trees of any size class. Journal of Forestry 24(3):272-274. 1 figure. March, 1926.

_____ Form class taper curves and volume tables and their application. Journal of Agricultural Research 35(8):673-744. 17 tables, 28 figures. October 15, 1927.

_____ Notes on use of form quotient based on full stem instead of form quotient for portion above breast height. Typewritten, 1 p. April 18, 1924.

_____ New basis for classifying trees by form. Typewritten, 11 pp. 1926.

_____ Individual tree records for study of change in form of residual trees after logging. Typewritten, 6 pp. February 23, 1926.

_____ Memorandum of office computations. Change in form after logging. Typewritten. 7 pp. October 16, 1926.

_____ Notes on use of logarithmic coordinate paper for conversion of individual tree measurements to percentile tapers. Typewritten, 2 pp. April 15, 1926.

_____ Notes on tests of form curves by localities. Typewritten. 2 pp. November 10, 1926.

_____ Memorandum on check of preliminary volume tables. Typewritten, 4 pp. November 22, 1926.

_____ Memorandum on relative accuracy of bark borer and hatchet for measuring thickness of bark. Typewritten. 4 pp. December 7, 1926.

Plans

Nothing further is planned under objectives 1, 2, and 3. Behre will finish his final report covering objectives 4, 5, and 6 this year. This will be submitted for publication in the Journal of Agricultural Research.

For the study of change in form after logging, the trees on the Cherry Mountain sample plots should be remeasured during 1930.

Assignment

C. E. Behre.

1930 Minor Project

MENSURATION

Project

Regional yields (ME-1, WO).

Scope

To bring together systematically all available data on the present and potential growth and yield of different species and types in the Northeast.

Status

This is a part of a Service-wide project which originated with the compilation of all available growth and yield data for use in preparing the report on "Timber: Mine or Crop?" Material pertaining to it is being secured as an integral part of several projects now under way.

Results

No progress has been made on this project.

Plans

Information will be secured incidentally as opportunity offers. An effort will be made to obtain figures as to the actual cuts from second growth stands.

Assignment

Staff, Northeastern Forest Experiment Station.

1930 Major Project

MENSURATION

Project

Growth and yield of spruce and balsam fir (ME-2).

Scope

To determine the growth and yield of spruce and balsam fir in different types and in even-aged and uneven-aged stands.

Status

This project has so far been limited to the study of the yield of even-aged, second growth stands of red spruce, white spruce, and balsam fir. Such stands are most often found on old pasture lands. Field work has included the measurement of some 400 temporary sample plots in various parts of Maine, New Hampshire, Vermont, and New York. The analysis of this data has been completed and the report written.

Fifteen permanent sample plots from 0.1 - 0.3 acres in size have been established in spruce stands of varying density and ages. Five of these are located on the Battell Forest in Vermont in cooperation with the state of Vermont, and 10 are on or immediately adjacent to the Gale River Experimental Forest near Twin Mountain, New Hampshire. These plots will eventually serve as a check on the results obtained from the measurement of temporary plots and provide information on mortality, approach of understocked stands to normal stocking, change in form of trees, and rate of growth in diameter, height, and volume.

Except for the establishment of 1 permanent sample plot of .3 acres on the Gale River Experimental Forest in 1928, nothing has been done on the very difficult and highly important part of this project; that is, the yield of spruce and balsam fir in uneven-aged stands mixed with hardwoods. Throughout the Northeast all but a small portion of spruce and balsam fir pulpwood comes from mixed stands of spruce balsam fir, and hardwoods.

Results

Yield tables in peeled cubic feet per acre and in board feet per acre by the International 1/8 rule have been prepared for normal (fully stocked) stands of red spruce from 25 to 115 years in age and for site indices 30 to 70, and of white spruce and balsam fir from 25 to 85 years in age and for site indices 40 to 70. For red spruce on the average site the mean annual volume production in cords for a rotation of 60 to 75 years is about 3/4 cord per year. For a 75 to 85 years rotation the mean annual growth in board feet is 300. At 65 years of age on the average site (site index 50) the total cubic foot volumes for red spruce, white spruce, and balsam fir are 5,250, 4,920, and 4,950 cubic feet respectively. At 85 years the board foot volumes by the International 1/8 Rule are respectively 26,300, 23,500, and 22,050 board feet.

In understocked stands the proportion of cubic foot volume to the fully stocked volume is much greater than the proportion of actual number of trees to the fully stocked number of trees. Red spruce stands with about 65% of the normal number of trees have the maximum board foot volume. However, the larger the number of trees, the greater is the total cubic foot volume. Moderate amounts of balsam fir and white spruce in a stand have practically no effect on the yields. The distribution of stems among the diameter classes of a stand follow a regular progression, based on the size of the average tree. Understocked stands approach a more fully stocked condition with advance in age.

Progress for 1929.

None.

Publications and Reports

Meyer, W. H. Yields of second growth spruce and fir in the Northeast. Technical Bulletin 142, U. S. D. A. 52 pp. 53 tables. 18 figures. 3 plates. November, 1929.

Plans

Nothing to be done until resources are available to undertake comprehensive study of yield in uneven-aged, mixed softwood and hardwood stands.

Assignment

1930 Minor Project

MENSURATION

Project

Converting factors (ME-2, WO).

Scope

To bring together systematically information upon converting factors used for converting timber measured in one unit into another unit.

Status)

Results)

This is an all-Service project upon which nothing has been done by the Northeastern Forest Experiment Station. Mr. Austin Cary has conducted some cordwood piling tests for pulpwood in Maine in the last three years, and these have added some new data on solid cubic contents of piled cordwood.

Plans

Information will be secured incidentally as opportunity offers.

Assignment

Staff, Northeastern Forest Experiment Station.

1930 Minor Project

MENSURATION

Project

Manual of field methods (ME-4, WO).

Scope

To prepare a manual covering the methods used in field studies, and particularly in sample plot work, in order to obtain more comparable results from studies undertaken by different agencies and in different forest regions through greater uniformity in the collection, compilation, and analysis of field data.

Status

A special committee with the Chief of Forest Experiment Stations as chairman and including representatives of the Forest Service, Society of American Foresters, and Association of State Foresters, was organized in 1926 to handle the project.

Results

An outline of the proposed manual has been circulated and commented on in some detail by the Station.

Publications and Reports

See under M-5.

Plans

To cooperate further when called upon by the committee.

Assignment

Staff, Northeastern Forest Experiment Station, in cooperation with special committee.

1930 Minor Project

PROTECTION

Project

Chestnut blight (Pd-1).

Scope

To study all phases of the chestnut blight, with special reference to the feasibility of replacing the practically extinct native chestnut with resistant varieties or species, or thru the development of resistant hybrids.

Status

The location of possible resistant trees of the native chestnut is being continued. While the tree is extinct as a timber species, it is still so well represented in the forests by partly dead trees, sprouts, and recent seedlings that it is difficult to distinguish resistant individuals. With further mortality it is believed that such trees will be more readily found.

Results

The work up to date has resulted in calling the attention of the public to such possibilities and the establishment of contacts which may lead to the discovery of resistant trees. As foreign stock of resistant species becomes available for test it can be planted on certain reserved lands of this vicinity which seem desirable for such a purpose.

Progress for 1929

A few Chinese chestnuts have been set out at the Massachusetts Agricultural

College grounds and on Mount Toby, in cooperation with Professor Grose of the Massachusetts Agricultural College. An increasing number of living and bearing trees of the native chestnut have been reported this year.

Publications and reports.

None.

Plans

Further work to be continued as at present until some definite lead may call for more extended investigations.

Assignment

Perley Spaulding.

1930 Major project

PROTECTION

Project

White pine blister rust (Pd-2).

Scope

Investigation of scientific aspects of the disease.

Status

The results of past investigations have been largely published. Studies of conditions in Europe have been published as a technical bulletin of the Department of Agriculture. The use and adequate testing of resistant species of white pines are being advocated and assisted.

Results

As a result of the European studies, supported by more recent publications in Europe, it has been determined that the Balkan white pine, Pinus peuce, is very resistant, if not immune, to the blister rust. Experimental planting of this species to test its forestry possibilities as well as its disease resistance is being encouraged. In the spring of 1926 and again in 1927 seeds were distributed to the state foresters of New England, New York, and Pennsylvania for trial. Because of the difficulty in securing germination the number of trees grown from these seeds will be small.

Progress for 1929

A technical bulletin has been published.

Publications and reports

Spaulding, Perley. The white pine blister rust: a comparison of European with North American conditions. U.S.D.A. Technical Bulletin 87. 58p. February, 1929.

Plans

Merely routine and incidental studies. The disease is a permanent factor in the Northeastern forests, and will require observation indefinitely. Continue the experimental plantation at Wilmington, N. Y., and continue encouragement of trial planting of Pinus Peuce.

Assignment

Perley Spaulding.

1930 Minor project

PROTECTION

Project

Pitch pine blister rust (Pd-3).

Scope

To determine the behavior of this native disease in comparison with the closely related introduced white pine blister rust.

Status)

:

Results :

Considerable data have been accumulated, which it is believed are sufficient to justify publication.

Progress for 1929

Little attention has been given this during the past year, except for preparation of a preliminary draft for publication.

Publications and reports.

Spaulding, Perley. Notes upon Cronartium comptoniae. Phytopathology 3:62. 1913.

_____ Notes upon Cronartium comptoniae II. Phytopathology 3:308-310. 1913.

_____ Notes upon Cronartium comptoniae and C. ribicola. Phytopathology 4:409. 1914.

_____ Notes on Cronartium comptoniae III. Phytopathology 7:49-51. 1917.

_____ , and J.R.Hansbrough. The sweet fern pitch pine blister rust, Cronartium comptoniae. Ms. for U.S.D.A. Technical Bulletin.

Plans

Entirely incidental observations and collections, and finish preparation of manuscript for final publication.

Assignment

Perley Spaulding and J. R. Hansbrough.

1930 Minor project

PROTECTION

Project

European larch canker (Pd-4).

Scope

To determine the distribution, hosts, and life history of this introduced tree disease; its relation to the native American fungus of larch and other conifers; and to eradicate diseased trees so far as is possible.

Status

In the spring of 1927 the true European larch canker was discovered at Hamilton, Mass., on imported European larches, which had been growing in that locality for about 20 years. It was also found on four other estates scattered in adjoining towns, and on single estates in Wellesley and Groton. The same type of disease was observed on Douglas fir, western yellow pine, and a single tree of Scotch pine, as well as on native eastern larch and Japanese larch. (There is a native fungus which very closely resembles the imported one and which is generally distributed on the native eastern larch from Newfoundland southward and westward an unknown distance. Fortunately, the native fungus is not an active parasite, while the European fungus is decidedly parasitic in action on living trees.) Much scouting has been done to locate European larch and Douglas fir plantations since this discovery was made.

To date the disease fortunately has been found in relatively few places and is so singularly restricted in distribution in these localities that it quite probably occurs only where it has been brought in upon diseased nursery stock. Because of this slow spread there seemed to be an excellent chance for the complete eradication of the larch canker from this country by prompt action. A detailed statement of the situation was included in the 1929 Investigative Program.

Results

All trees which were diseased have been destroyed at Groton, Wellesley, Proctor estate, Rice estate, and the Palmer estate at Ipswich. Most of the infected trees at Hamilton have been destroyed, but some reinspection and cutting are needed to fully complete the work there. Diseased Douglas firs are still standing on the Batchelder estate near Wenham. Cutting of all the diseased older Douglas firs at Potowomutt, R. I. has been done. Intensive scouting has been carried on throughout New England, New York, and further west, but no more of the canker has yet been found.

Progress for 1929

Scouting has been continued in all plantings of European larch, Douglas fir, and western yellow pine that could be located in New England. A number of places scouted last year have been re-examined.

Publications and reports

Spaulding, Perley, and Siggers, P. V. The European larch canker in America. Science, n.s., 66:480-481. Nov. 18, 1927.

_____ The European larch canker in Massachusetts. Report, Proc. 14th Annual Blister Rust Control Conference held in Providence, R. I., Nov. 19-20, 1928. p. 59. Mimeographed.

Plans

Because of a definite appropriation for this work, other pathologists have been assigned to it and the Station pathologist relieved, except in an incidental way.

Assignment

Perley Spaulding and J. R. Hansbrough. During the past year Messrs. N. O. Howard, G. G. Hahn, and a number of others have spent portions of their time working on this disease

1930 Minor project

PROTECTION

Project

Shade and ornamental tree diseases (Pd-3).

Scope

To answer inquiries on this subject.

Status

Entirely incidental and limited to local cases. A few cases require handling each year.

Results

The European larch canker was brought to the pathologist's attention as a result of an inquiry accompanied by a specimen of a diseased tree.

Progress for 1929

During the past season considerable time has been given to the rapidly spreading disease of willows of the northern sea coast. A 3,000-mile automobile trip was made through the provinces of Nova Scotia, New Brunswick, and Quebec, as far west as the city of Quebec and southward. The disease has been found associated with two distinctly parasitic fungi, and is distributed as far west in New York as the middle of the state, and in the Hudson-Champlain valley as far north as Crown Point, N. Y.; in Vermont north to Duxbury, and in New Hampshire, north to Twin Mountain. On the Canadian trip special search was made for resistant species of Salix. Several were found.

Publications and reports

Spaulding, Perley. Willow scab (Fusicladium saliciperdum). Plant Disease Reporter. 13:74. July 13, 1929; 13:142. October, 1929. Mimeographed.

_____ Willow disease (Physalospora miyabeana). Plant Disease Reporter, 13:142-143. October, 1929. Mimeographed.

Collins, J. F., and Spaulding, Perley. Willow disease in the Eastern Canadian Provinces. Plant Disease Reporter 13:143-144. October, 1929. Mimeographed.

Plans

Routine examination of specimens submitted, and answer to inquiries.

Assignment

Perley Spaulding in cooperation with J. F. Collins.

1930 Minor Project

PROTECTION

Project

Miscellaneous forest tree diseases (Pd-6).

Scope

To include all miscellaneous work upon forest tree diseases which involve too little work to justify a separate project.

Status

A considerable number of specimens of tree diseases and of the fungi causing

them have been accumulated. These are valuable for reference and are filed for such use. Indexing of literature on forest tree diseases of the Northeastern states is necessary for a knowledge of what is to be expected, for methods of treatment and investigation, for hosts, and for distribution. This is handled on a basis aimed to conserve time and labor, yet to furnish the needed information

Results

The finding and preliminary investigation of Nectria canker diseases of numerous hardwood species, which quite certainly will assume considerable importance in the near future. The placing of Stereum sanguinolentum, common as a rapid decay agent of coniferous wood, in the class of fungi which demand increased attention.

Progress for 1929

Several different species of Dasyscypha have been encountered. It is likely that it will be found that some of them are disease-causing fungi. A locally serious disease of white pine apparently caused by Caliciopsis pinea has been found to be widely distributed in New York and New England.

Publications and reports

Spaulding, Perley. A serious disease of birches. Phytopathology. 17:59. 1927.

_____ Relation of pathology to forestry in the Northeast. Canadian Woodlands Review. 13:7-8,18. July, 1929.

_____ Some wood inhabiting fungi of Vermont. Vermont Botanical and Bird Clubs, Joint Bulletin 14:28-50. 1930.

Plans

It is proposed to continue the present lines of work as supplementing that carried on under definite projects.

Assignment

Perley Spaulding.

1930 Major Project

PROTECTION

Project

Weather and fuel relationships (Pf, B-5.)

Scope

To determine the relationships between weather conditions and the inflammability of forest fuels.

Status

In 1925, a fire weather station was set up at the College of Forestry Camp, Cranberry Lake, New York. It was maintained with the cooperation of the New York State College of Forestry, Syracuse, New York, and the Empire State Forest Products Association, Albany, New York. Two additional stations - Petersham, Massachusetts, and Elk Lake, New York - were established in 1926. The Petersham station was established with the aid of the Harvard Forest, Petersham, Massachusetts, and that at Elk Lake with the assistance of the New York Conservation Department, Albany, New York, and Finch, Pruyn and Company, Glens Falls, New York. The Maine Forest Service contributed funds for a fourth station located at Smyrna Mills, Maine, which was opened in 1927. All of the above agencies have continued cooperating, so that the four stations have been maintained continuously since their establishment.

The stations are located in the following forest types: Cranberry Lake, spruce and hardwood type; Petersham, northern white pine type; Elk Lake, spruce slope type; and Smyrna Mills, spruce flat type.

At each investigational area duplicate meteorological stations are set up: one in the open and a second in adjacent green timber. Four daily observations at 8 a.m., 11 a.m., 2 p.m., and 5 p.m. are made of the following meteorological factors and forest fire hazard conditions: Air temperature and air pressure within the instrument shelter, relative humidity, vapor pressure, depression of the dew point, duff temperature at surface, soil temperature at one inch depth, duff moisture content at surface, duff moisture content at one inch depth, evaporation at soil level, wind velocity at 3½ feet above the ground, precipitation, and cloud formation. In addition to the routine observations, continuous records of air temperature and relative humidity are obtained by hygrothermographs located in the instrument shelter of all open stations.

In order to evaluate expressions of duff moisture content into terms of actual forest fire hazard, inflammability tests have been made at 3 stations - Petersham, Smyrna Mills and Cranberry Lake. For these tests such common fire brands as matches, cigarette butts, pipe heels, and small camp fires are used. The factors measured during such tests are: relative humidity, air temperature, duff moisture content by means of individual samples collected before conducting the test, wind velocity in feet blowing across the duff, and duration of test in minutes and seconds.

Continuous readings on the drying-out rate of the duff in the open and in the forest under various types of weather have been secured at all 4 stations. These readings, taken at 15 minute intervals thruout the day augment the routine observations. The factors measured are dry and wet bulb temperatures, duff temperature, duff moisture content in surface layer, and cloud formation.

Since 1928, soil moisture determinations were made at all stations excepting Elk Lake. The soil samples were collected at both open and forest stations at 2 p. m. daily. In order to find out exactly how much water is retained in the duff after different amount of precipitation, duff samples were collected and dried out at Petersham, Cranberry Lake, and Smyrna Mills whenever the duff hygrometer readings exceeded 50 per cent.

In general the Petersham station has served as the central station in the fire weather studies. Excellent opportunities have been available to tie in this project with the study of the relation of solar radiation and soil moisture to tree growth (T-1). During the 1926 field season daily radiation data were secured at the open and forest stations. For 3 months during 1927 3 different solar radiation intensity stations were established by shielding the duff with frames covered with various thicknesses of cheese cloth. One station was fully exposed, a second was shielded by a screen which allowed only 30% of full radiation to fall upon the duff, and a third received approximately 50-60% of full radiation. On these areas duff moisture content in surface layer, duff temperature, and light intensity were measured.

Since 1927 daily telegraphic reports have been forwarded to the Weather Bureau offices at Albany, New York, and Boston, Massachusetts from the stations of Cranberry Lake and Smyrna Mills, respectively. These reports aid in formulating the fire weather warnings issued by the Weather Bureau.

The data secured at the 4 fire weather stations have been coded, transferred to punch cards for machine tabulation, averaged, and summarized each year.

At Amherst, year-long evaporation records have been taken with the Bates' evaporimeters, since January, 1927. The instruments are read 3 times each month. These evaporation data will be of use in the fire weather studies, especially in showing the air moisture conditions preceding the fire seasons in the spring.

Results

No comprehensive analyses of the data have been made to date, since it is planned to secure a minimum of 5 years' records for each station before commencing any detailed report.

Preliminary studies of the records indicate that in the absence of precipitation, relative humidity seems to be the controlling factor of fire hazard. Between rainy periods (where the moisture content of the atmosphere and of the duff are at equilibrium) there is a very close correlation between the amount of moisture in the atmosphere and the moisture content of the duff in the surface layer and at one inch below the surface. Other factors which appear to be of primary importance are air temperature, duff temperature, and solar radiation. These last mentioned factors play an important part in changing the water in the duff from a liquid to a gas in which form it is lost into the surrounding air. In general, there is every indication that during the fire seasons, 2 p.m. air temperatures of 70° F., and relative humidities of 40% or less are indications of hazardous fire conditions. Vapor pressure thus far has been the best guide to the trend of the weather.

The inflammability tests show that when the duff moisture content falls below 20 per cent, fires are started by all the fire brands used in this work. The ease with which fires can be started with matches, pipe heels, cigarette butts, and small camp fires depends upon the quality and structure of the duff, as well as upon the moisture present. Thus, for example under equally low duff moisture conditions, fires can hardly be started with matches in pure red spruce-balsam fir duff, while with an increase of hardwood leaves into such a mixture of coniferous leaf-fall fires are

started without any difficulty by this fire brand. Similarly, while pipe heels and cigarette butts often fail to start fires in pure hardwood duff even when the moisture content is very low, the same fire brands are extremely dangerous in the compacted coniferous duff. In general the fire brands can be rated as follows from the most dangerous to the least dangerous: camp fires, matches, pipe heels, and cigarette butts.

Progress for 1929

All four stations were set up and maintained during 1929 with the agencies listed above. The Cranberry Lake station was in operation from March 31 to October 31; the Petersham station, from April 4 to November 20; Elk Lake station, from May 15 to October 31; and Smyrna Mills station, from May 31 to October 4. There are now 5 years' data for Cranberry Lake (1925-1929); 4 years' data for Elk Lake and Petersham (1926-1929) and 3 years' data for Smyrna Mills (1927-1929).

Inflammability work was carried on at all stations except Elk Lake. Coal sparks, similar to those thrown out by steam railroad engines, were added to the fire brands used. All told, approximately 1100 inflammability tests have been completed. These cover a wide range of duff moisture conditions and are now sufficient in number to draw up scales of forest fire hazard under duff moisture content varying from 0 to 50 per cent for all three types of duff investigated.

At Petersham two minor investigations were initiated - a study of the relationship between duff and soil moisture contents, and an experiment with calcium chloride as a possible forest fire retardant.

The study of the relationship between duff and soil moisture contents was undertaken as a supplement to the soil moisture determinations made daily at 2 p.m. at all stations except Elk Lake. Two small plots 4x4' were laid out in the open. Both areas were completely enclosed by strips of galvanized iron 6" wide. The iron strips were pressed into the soil to a depth of 3" so that the surface soil layers of the plots were isolated from adjacent surface soil. The duff down to the bare soil was removed from both plots and the bare soil of one plot was covered with a coating of paraffin. Duff and litter to a uniform thickness of 2" was then applied to each plot. Duff samples were taken daily from each plot as well as a soil sample of the surface soil adjacent to the plots. These were used in determining the daily duff and soil moisture contents. The experiment was carried on for about 45 days. It was expected that during dry periods the duff on the wax covered plot would be considerably drier than the duff on bare soil. No such distinct relationship could be drawn from the data obtained. The thickness of the duff layers used, plus the fact that during the course of the experiment the weather was cold and rainy, may perhaps account for the lack of any results from this experiment.

The experiments with calcium chloride as a possible forest fire retardant gave promise that this chemical may have use in forest fire protective work. Litter and duff treated with solutions of calcium chloride remained moist for considerable periods after treatment.

As in past years, daily telegraphic reports were forwarded to the Weather Bu-

reau offices at Albany, New York, and Boston, Massachusetts from the stations at Cranberry Lake and Smyrna Mills respectively. Monthly summaries of the Elk Lake data were sent to the Weather Bureau at Albany, New York and to the Finch, Pruyn Company, at Glens Falls, New York. The Boston Weather Bureau office also received a daily record from the Petersham station.

Publications and Reports

Stickel, P. W. Importance of meteorological studies in forest fire prevention. In Proceedings of Forest Protection Conference, New York State College of Forestry, 58-68. 6 figures. November, 1926.

_____ Suggestions for carrying on forest fire weather studies. Typewritten. 10 pages. December, 1926.

_____ Instructions to fire weather observers. Typewritten, 12 pages. January, 1927.

_____ Forest fire weather research. Journal of Forestry 5: 604-605. May, 1927.

_____ Report to the Empire State Forest Products Association of progress at the Elk Lake fire weather station. Typewritten, 8 pages. October, 1927.

_____ Forest fire weather research. Mimeographed by Quebec Forest Industries Association, Ltd. 10 pages. January, 1928.

_____ Comparative forest fire hazard in the Northeast. Journal of forestry 4: 456-463. 1 table. April, 1928.

_____ Forest fire weather in central Massachusetts. Monthly Weather Review 56: 134-136. 4 figures, 2 tables. April 1928.

_____ The problems and aims of fire weather research under way at the Northeastern Forest Experiment Station. Typewritten, 8 pages. December, 1928.

_____ The causes and cost of forest fires in central Massachusetts. Technical Note No. 2, Northeastern Forest Experiment Station, July 1929.

_____ A report on the use of calcium chloride as a possible forest fire retardant. Typewritten. 10 pages, 2 figures, 1 table. November, 1929.

_____ Forest Fires in central Massachusetts. Their causes and cost to the Commonwealth. Journal of Forestry 7:841-844. 3 tables. November, 1929.

Gast, P.R. and Stickel, P.W. Solar radiation and relative humidity in relation to duff moisture and forest fire hazard. Typewritten. 9 pages, 1 figure, 1 table. Accepted for publication by the Monthly Weather Review. November, 1929.

Stickel, P. W. Forest fire weather in the western Adirondack Mountains: its measurement and interpretation. (Tentative title.) 75 typewritten pages, 20 graphs, 5 photographs. Manuscript to be completed at the close of 1930 and published as a technical bulletin of the New York State College of Forestry.

Plans

The 1929 data will be transferred to punch cards, sorted, and tabulated. Office work will be concentrated on the Cranberry Lake data in order to complete the final report of that station by the end of 1930. Routine observations will be continued at Petersham, Massachusetts, Elk Lake, New York, and Smyrna Mills, Maine. At Petersham further field experiments will be carried on with calcium chloride as a possible forest fire retardant, and more work will be done on the relationship between duff and soil moisture content.

Assignment

P. W. Stickel, in cooperation with the New York State College of Forestry, the Harvard Forest, the Maine Forest Service, the New York State Conservation Department, Finch, Pruyn and Company, the Empire State Forest Products Association, and the United States Weather Bureau.

1930 Major Project

PROTECTION

Project

Prediction of fire weather (Pf, C-7).

Scope

To work out methods for predicting the occurrence of fire weather more accurately and for longer periods in advance than is now possible.

Status

This is primarily a Weather Bureau project which is, however, closely connected with the study of weather and fuel relationships (Pf, B-5), and in which the Experiment Station cooperates actively in translating predictions of fire weather into terms of actual fire hazard. Seventeen special fire weather stations have been installed in the New England states, and in addition the Massachusetts Agricultural College Experiment Station and the Winter Hill Observatory at Worcester, Massachusetts, furnish records. These stations report to Boston. Several fire weather stations have been established in New York from which reports are sent to Albany. The special fire weather station located in Connecticut, as well as the regular Weather Bureau station at Hartford, forwards daily special messages to New Haven.

Results

Since 1925 forecasts have been issued daily from the Boston office of the Weather Bureau by telegraph to various sections of New England during hazardous periods. Forecasts have been issued from Albany, New York, since 1925, and from New Haven, Connecticut, since 1924.

Much has been done in preparing weekly normal, weekly mean maximum, weekly mean minimum, and weekly absolute maximum temperatures from March to December for each of the 10 sections into which the New England states have been divided for fire weather purposes.

Progress for 1929

General progress was made in carrying out the Weather Bureau fire weather plan. Approximately 900 forecast messages were sent out by telegraph from the Boston office, in addition to the telephone distribution from the Albany and New Haven offices.

The research program has been going forward as rapidly as possible, and at the end of the year most of the initial selective tabulation work had been completed, preparatory to an analytical study of conditions conducive to fire weather.

Publications and report

None.

Plans

Continue along the same general line. Issue fire weather forecasts to the interested cooperators and to the general public through the medium of publicity. A general advancement in the research work is looked forward to, with the possible completion of a report anticipated, based on the material available at this time.

Assignment

T. E. Reed, Weather Bureau, in cooperation with other Weather Bureau officials, Northeastern Forest Experiment Station, and State Foresters.

1930 Major Project

PROTECTION

Project

Analysis of forest fire statistics (Pf, D-2).

Scope

To secure from an analysis of available records as complete and accurate information as possible in regard to forest fire hazard, risk, and damage in different parts of the Northeast.

Status

Fire records have been tabulated and compiled for the 4 states with which the station is cooperating, as follows:

Maine	1915-1926
New Hampshire	1921-1925
Vermont	1909-1926
Connecticut	1921-1925

Report for New Hampshire completed and published; report for Maine completed and submitted to state forester for publication.

Results

In New Hampshire it is shown that although the number of fires in relation to forest area and to population appears relatively large, the total number is not excessive. The size of the average fire and the percentage of forest area burned are relatively low, although still considerably higher than the figures ordinarily used as a standard. Disastrous conflagrations are apparently rare, as is evidenced by the comparative uniformity in the number of fires, damage, and cost of suppression as between different years. The fire hazard is highest in the southern part of the state which, with 46 per cent of the forest area and 49 per cent of the population, has 78 per cent of the total number of fires. As a result, area burned, value of timber destroyed, and cost of suppression all bulk considerably larger in the southern than in the northern group of counties. On the other hand, the size of the average fire, the loss per fire, and the cost of suppression per fire average considerably higher in the northern group. Smoking is the outstanding cause of fires, being responsible for approximately half of the total number in every county in the state. Education of the general public as to the causes and seriousness of forest fires, strict enforcement of the forest fire laws, and the strengthening of fire protective organizations are probably the chief needs in the state. Specifically, these measures should aim at the reduction of the number of fires in the southern part of the state, particularly in Rockingham county, and of their size in the northern part.

In Maine the statistics show that while the number of fires and the damage sustained are not alarming, the size of the average fire, 163 acres, is way beyond the average of 10 acres per fire sometimes set as the standard toward which control organizations should work. This is particularly true in the northern part of the state, with an average of 179 acres per fire, where various factors combine to make the prompt suppression of fires difficult. In the southern part of the state the average is 47 acres per fire. Special effort should be made to reduce the size of the fires. Smoking caused the largest number of fires.

Progress for 1929

Report for Vermont nearly completed. Analysis of Connecticut statistics completed and manuscript being drawn up.

Plans

Completion of report for Connecticut, and preparation of report for region as a whole.

Publications and reports

Dana, S. T. Forest fires in New Hampshire, 1921-1925. Biennial report of the Department of Forestry, State of New Hampshire. 47 pp., 27 figures, 7 tables. 1928.

_____ Forest fires in Maine, 1915-1925. Typewritten. 56 pp., 33 figures, 26 tables. 1928. (To be published as a bulletin by the Maine Forest Service.)

Assignment

S. T. Dana, in cooperation with the state foresters of Connecticut, Maine, New Hampshire, and Vermont.

1930 Major Project

PROTECTION

Project

Control of the white pine weevil (Pi-4).

Scope

To study the life history and habits of the white pine weevil and to determine practical and effective measures for its control and for minimizing the injury caused by it.

Status

This project was begun in May, 1925. The investigations thus far undertaken, with the exception of the permanent plot studies and certain life history studies, have been completed and are in process of publication.

Results

Some important information has been obtained on life history and habits. The investigation has confirmed the belief that the most advantageous way to protect white pine from this weevil is to grow it in mixture, preferably with some species that will be of value in the final crop. The choice of the species will be determined by the economic conditions in any given locality. A dense pure stand is practical only when it can be obtained naturally and at a high enough density to offset any weeviling which may occur. Direct control measures are generally too expensive for common practice. Control by parasitic or predaceous insects, birds, wood mice, and moles is uncertain, but reduction in numbers of the weevil by these agencies is undoubtedly of great importance.

Progress for 1929

About one month of the field season of 1929 was spent in checking over the permanent sample plots.

Publications and reports

MacAloney, H. J. The white pine weevil in New England. Proceedings of Forest Protection Conference, New York State College of Forestry, Syracuse, N. Y. November, 1926.

_____ Mixed stands the best protection against the white pine weevil. 1 p. Forest Worker, March, 1928.

_____ The white pine weevil as a shade tree pest. Proc. Nat. Shade Tree Conference, Brooklyn, N. Y. January, 1929.

_____ The white pine weevil (Pissodes strobi Peck), its biology and control. Approximately 50 pp., 4 tables, 15 plates, 7 graphs. Completed, June, 1929. Submitted as partial requirement for the degree of Doctor of Philosophy, New York State College of Forestry, Syracuse, N. Y.

_____ The white pine weevil. Approximately 20 pages, 10 plates, 4 graphs. Completed, September, 1929. Submitted to Bureau of Entomology for publication as departmental bulletin.

_____ The relation between weather conditions and the prevalence of white pine weevil injury. Submitted to the Forest Worker, December, 1929.

Plans

Permanent sample plot studies and life history studies will be continued indefinitely. Special attention will be directed toward possibilities of control during period adult weevils are on the ground. Preliminary experiments aimed to discover an attractant to make trapping possible will be undertaken in 1930.

Assignment

H. J. MacAloney, in cooperation with the Harvard Forest, New York State College of Forestry, Massachusetts Timberland Owners, State Foresters and Entomologists, and the Entomological Branch of the Dominion of Canada Department of Agriculture.

1930 Major Project

PROTECTION

Project

Control of the bronze birch borer (Pi-6).

Scope

To study life history and habits of the bronze birch borer, to determine its importance, and to work out practical measures for control of the insect by forest management.

Status

Serious deterioration of birch following thinning or partial cutting of the stand has been attributed to the bronze birch borer. The work of the bronze birch borer has been studied since 1926 extensively by reconnaissance, and intensively on permanent sample plots established about 25 years ago in Corbin Park Game Preserve, Grantham, New Hampshire, and on plots recently laid out on the White Mountain National Forest and at Corbin Park Game Preserve. The insect was also studied by a survey, supplemented by a large number of temporary plots in Michigan and Wisconsin during 1928. The effect of changed conditions of the environment following logging and of certain fungi may prove more important than the bronze birch borer in the deterioration of the trees.

Results

The results of the investigation in the northern Lake States confirmed the information previously obtained in New Hampshire that the bronze birch borer seems to be secondary rather than primary. In the Lake States paper birch seems to be the favorite host, while in New Hampshire yellow birch is attacked most.

Following logging there is a significant change in important physical factors of the environment, including air temperature, relative humidity, wind velocity, duff temperature, soil temperature down to a depth of 36 inches, amount of sunlight, evaporation, tree temperature, and moisture content of sapwood of living trees. The moisture content of sapwood increases considerably as the trees decline in vigor. The shoestring fungus, Armillaria sp., was found in the base of many trees on a cut over area.

Preliminary experiments indicate that temperatures over 136° F. are needed to kill birch cambium. The highest tree temperatures recorded were 108°, but duff temperatures up to 171° F. were recorded.

Progress for 1929

The work during 1929 was principally directed to study of the changes in physical factors of the environment as a result of logging. This study was conducted near Waterville, N. H. Observations were made at three stations; one an uncut area containing good representation of both paper and yellow birch; a second on an adjacent area cut over in the winter of 1928-29; and a third in a similar area near by, which had been cut in 1925-26. The following measurements were taken daily on each area: air temperature; relative humidity; air pressure; wind velocity and direction; duff temperature at the surface and one inch depth; soil temperature at 2, 6, 12, 24, and 36 inches; tree temperature, underneath bark, at the north and south sides at the base, 15 and 50 feet up; precipitation; evaporation; amount of sunlight; intensity of sunlight; and moisture content of duff, soil, and sapwood of living trees.

Publications and Reports

Hall, R. C. Progress report for the bronze birch borer study in New England. Typewritten, 3 pp. December, 1928.

_____ The bronze birch borer. 1 page. Forest Worker. July, 1928.

_____ Preliminary report for the bronze birch borer investigations in northern Lake States for summer, 1928. Typewritten, 12 pp. January, 1929.

_____ Progress report for a study of some of the changes in the physical factors of a forest environment brought about by logging. Typewritten 15-20 pp. January, 1930.

Plans

Work will be continued in 1930 in the Lake States. Special attention will be given the relation between the borer and the shoe string fungus, fatal high temperatures for birch cambium, and moisture content of living trees. The study of physical factors of the environment and life history of the borer will also be continued.

Assignment

R. C. Hall, School of Forestry and Conservation, University of Michigan, Perley Spaulding, and H. J. MacAloney, in cooperation with Bureau of Plant Industry and White Mountain National Forest.

1930 Major Project

TYPES

Project

Relation of radiation (light) and soil moisture to tree growth (T-1).

Scope

To determine the role played by radiation (light) and soil moisture in the establishment and subsequent development of different species under various conditions. The species to be studied first are northern white pine and red spruce. Adequate apparatus and methods are to be developed where necessary.

Status

In cooperation with the Eppley Laboratories, Inc., a spherical thermopile has been brought to the stage of commercial development as a precise radiometer.

The calibration of the thermopiles has made it possible to give the radiation measurements in terms of absolute units, that is, heat units received on a unit of surface in a unit of time. The conversion of this data is completed.

The necessary revision of manuscript to include the improvements in design of the thermopile, the description of its characteristics, and the discussion of the relation of growth to the radiation intensities in terms of absolute values is completed.

The possibilities of the capacity method of determining soil moisture have been examined. The method is apparently without value for present purposes.

Results

The spherical thermopile has been calibrated and its precision examined. Facilities for this were provided thru the courtesy of the Eppley Laboratories, Inc. The instrument was found to be of good accuracy, of a rather large time lag as compared with certain types, and certain alterations were indicated to improve the uniformity of registration with varying angle of incidence. The time lag is not a disadvantage, but rather an advantage when used with a chopping recorder. The changes indicated for improvement of characteristics are now in progress.

For the study of the effect of radiation on the growth of northern white pine, seedlings 11 years old growing in 3 degrees of irradiation intensity were used. These seedlings were established under a shelterwood. The 3 degrees of irradiation intensity were obtained by (1) a complete removal of the overwood, giving complete "open" insolation; (2) a partial removal, leaving a canopy estimated as 40%; and (3) leaving the overwood as after the first thinning, estimated as an 85% canopy. The leader growth is apparently proportional to radiation as measured by the thermopile used, up to the intensity of full sunlight. How far this iconoclastic result may be due to the neglect of the possible increase in available soil moisture because of the removal of root competition and/or the possible increase in rate of nitrogen liberation because of increased humus transformation of the higher soil temperatures cannot be stated.

In a study of synchronous data on relative humidity obtained at Petersham in the study of weather and fuel relationships (Pf, B-5) and the radiation study, it was found that the two could be correlated. Using all the data available, 172 3-hour periods in August and September 1927, a regression coefficient $r = -.76$ was obtained. Relative humidity has been shown to be a valuable criterion in predicting fire hazard, presumably because it was an index of the saturation deficit of the atmosphere and the avidity with which it removes water from inflammable material. On the basis of the data on hand, it would seem that relative humidity is valuable rather as an index to the intensity of solar radiation which vaporizes the water in exposed inflammable materials.

Progress for 1929.

Manuscript on thermoelectric radiometer for silvical studies completed.

Publications and reports.

Gast, P. R. Manual of radiometry for plant physiologists. Typewritten, 1000 pages. 3 tables. 1927.

_____ A thermoelectric radiometer for silvical studies. 71 pages, 22 figures. Accepted as bulletin of the Harvard Forest. In page proof. October, 1929.

_____ A correlation between solar radiation and relative humidity. Typewritten. 6 pages, 5 tables. Accepted for publication by Monthly Weather Review. November, 1929.

Plans

None; project will be inactive until Doctor Gast returns from Europe.

Assignment

P. R. Gast, Northeastern Forest Experiment Station and Harvard Forest.